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MEXICAN GEOLOGIST MARÍA FERNANDA CAMPA AND THE MEXICAN PETROLEUM INSTITUTE (1965–2025)

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In Mexico, as in other countries, petroleum geology is one of the youngest specialties within the geological sciences, associated with hydrocarbon exploration in the early 20th century. In 1965, the Mexican government authorized the creation of the Mexican Petroleum Institute (IMP, for its Spanish acronym) as the technological arm of Petróleos Mexicanos (PEMEX), the state-owned company responsible for the production, refining, and commercialization of oil and natural gas in Mexico. The IMP's functions included research, technological development, innovation, and the optimization of production processes. To achieve its objectives, the IMP was organized into specialized departments and laboratories, where, for the first time, women were also employed. One of the pioneers was María Fernanda Campa (1940–2019), who had just earned her degree in Geological Engineering from the National Polytechnic Institute in 1965.

Since at least the 16th century, mineral resources have been one of the main sources of income for Mexican governments. The tradition of scientifically extracting minerals from the soil was a characteristic feature of the economy as early as the 18th century, when mining represented the most important industrial sector. During that period, a college was founded to train experts in resource exploitation, and knowledge of the country's mineral reserves was promoted. Given the importance of disciplines and practices such as geology, closely tied to the development of the national economy, this field was considered strategic by the State. This highlighted the need to establish an institution tasked with evaluating and recording mineral resources. In 1888, the Geological Institute of Mexico was founded as a government agency which, over the years, gained social recognition as an independent discipline devoted to the pure and applied study of fossils, meteorites, minerals, fossil fuels, among others.

With the arrival of the 20th century, the first oil prospecting activities began in Mexico. In 1901, Edward L. Doheny (1856–1935), director of the Mexican Petroleum Company, founded that same year, ushered in a new era of oil exploration and production, now in the hands of companies with mostly foreign capital. These activities took place in the Gulf of Mexico region known as the "Golden Lane" (Faja de Oro in Spanish), bordered to the north by Tampico, Tamaulipas, and to the south by Poza Rica, Veracruz. For many years, this area was the center of the oil boom,where the extraction and administrative activities of the petroleum industry were concentrated.

Fig. 1. On April 3, 1904, Mexican engineer Ezequiel Ordóñez, a geologist with the Geological Institute of Mexico, discovered *La Pez No. 1* in the municipality of Ébano, San Luis Potosí—the first commercially productive oil well in Mexico. This event marked a milestone in the country's petroleum exploitation. The photograph shows a field excursion to the Ébano oil region organized as part of the 10th International Geological Congress held in Mexico in 1906, during which Ordóñez served as guide. Courtesy of the Historical Archive of the Geological Institute of Mexico, UNAM.

When crude oil exploitation began in Mexico in 1901, annual production reached 10,334 barrels. This figure increased exponentially within just ten years: by 1911, annual output exceeded 12 million barrels. By 1918, Mexico had become the second-largest oil producer in the world, surpassing Russia (Lupercio, 2022:29). Alongside the growth of the national oil industry, various subfields of geology, such as paleontology and geophysics, began to develop, serving as key sources of data and methods for oil field exploration.

The end of the oil boom came on March 18, 1938, when President Lázaro Cárdenas orchestrated the compensation and expulsion of the foreign multinational companies that owned and operated the country's petroleum assets. The oil expropriation represented the nationalization of Mexico's hydrocarbon resources; in other words, PEMEX became the sole entity responsible for the production and commercialization of Mexican oil. This shift meant that nearly all of the information contained in company archives, along with the qualified technical personnel, mostly of foreign origin, left the country. As a result, Mexico fell victim to a form of "technological colonialism" in the exploitation of its petroleum resources (García-Colín, 1979:81).

Some activities resumed one or two years after the expropriation, though irregularly and in a scattered manner, often carried out by inexperienced technicians. On March 18, 1940, Vicente Cortés Herrera, general manager of Petróleos Mexicanos, reported:

> ...geological exploration has suffered due to the lack of technical personnel. Unfortunately, this work is of the greatest importance for maintaining the standing that the Mexican oil industry has held up to now. As a result, no truly significant geological exploration has been carried out that could have led to the discovery of new structures. Some locally relevant work has been done, and efforts have primarily focused on analyzing the available data recovered from company archives, which has been complemented through arduous work. Our technicians are now familiar with what is known about the oil-interest zones… (Meneses, 1983:25)

In this context, the early 1940s saw significant advancements in the geological knowledge of Mexico's entire territory. Dozens of field teams collected data on the country's surface geology, and specialized studies were gradually incorporated, eventually enabling the exploration of previously unknown marine areas. Thus, with the implementation of new oil policies beginning in 1917, the Mexican government, eager to assert control over private companies, promoted efforts to increase knowledge about the country's oil reserves and hydrocarbon extraction operations. This situation created a growing demand for specialists, while also revealing concerns about the lack of educational programs, specialized training, and modern chemical laboratories dedicated to petroleum research in Mexico. Although there were initiatives to establish and/or enhance institutions devoted to oil-related education and research, key examples include: the National School of Engineers (Escuela Nacional de Ingenieros, 1792), the Geological Institute of Mexico (1888), the Petroleum Technical Commission (1915), the Petroleum Department (1916), the National School of Chemical Sciences (1916), and the Department of Geological Studies and Exploration of the Ministry of Industry, Commerce, and Labor, created in 1917, to which the Geological Institute was transferred. The creation of these institutions was crucial for advancing knowledge of the country's energy resources, as they were responsible for technical oversight of oil lands, exploratory wells, production activities, and the construction of pipelines, all in accordance with the 1917 Constitution, the national charter that emerged from the armed Revolution of 1910.

Regarding professional education, the Petroleum Engineering program was established in 1927 at the National School of Engineers. Nine years later, in 1936, the geology program of the Faculty of Sciences—created in 1932—was transformed into Geological Engineering, now within the National School of Engineers at the National Autonomous University of Mexico

(UNAM). That same year, 1936, President Lázaro Cárdenas inaugurated the National Polytechnic Institute (Instituto Politécnico Nacional), a bastion of technical education "in service to the nation," which began offering degrees in Geological Engineering and Petroleum Engineering. These higher education and research institutions trained the first generations of geologists in the country, who would go on to be employed by Petróleos Mexicanos (PEMEX), the Mexican Petroleum Institute (IMP), and geological research centers.

Participation in professional training programs in the field of geology remained exclusively male until 1944, when Josefa Cuevas de Sansores (1920–2010) became the first woman to enroll in the National School of Engineers at UNAM. She would later become the first woman in Mexico to earn a geology degree in 1950. While still a student, she worked in the Paleontology Department of PEMEX's Exploration Division. Later, María Fernanda Campa Uranga, the first woman to graduate as a Geological Engineer from the National Polytechnic Institute in 1965, began working at the Mexican Petroleum Institute from its founding that same year. For many years, she was the only woman to lead an exploration brigade at PEMEX. She also distinguished herself in the field of tectonics and contributed significantly to the geological understanding of central and southern Mexico.


ESCUELA SUPERIOR DE INGENIERIA Y ARQUITECTURA
INSTITUTO POLITECNICO NACIONAL
La presente acredita al Sr.ita.
MA. FERNANDA CAMPA URANGA
como alumno de esta Escuela.
Carrera INGENIERO GEOLOGO
Domicilio Compás No. 38
1962 AÑO
173-58 BOLETA
EL DIRECTOR
EL ALUMNO

Figure 2. Student ID card from the Geological Engineering undergraduate program at the National Polytechnic Institute (IPN). María Fernanda Campa Uranga was the first woman to earn a degree in Geological Engineering from IPN in 1965—the same year the Mexican Petroleum Institute (IMP) was founded, where she worked for several years. Courtesy of the Historical Archive of the Institute of Geology, MFCU Collection, box 47.

Before graduating as a Geological Engineer, María Fernanda Campa began working at PEMEX in the reservoir department. Between 1969 and 1972, she became the first woman to hold the position of Head of the Geological Exploration Department within the company. At the Mexican Petroleum Institute (IMP), she was a founding member of the Petrography Laboratory in 1965 and the Reservoir Geology Laboratory in 1967. She pursued her Master's and Doctoral studies in the Faculty of Sciences at the National Autonomous University of Mexico (UNAM) between 1971 and 1980, specializing in geology.

During her postgraduate studies and professional work at PEMEX, Campa introduced controversial ideas regarding the geological configuration of central and southern Mexico. In her master's thesis, *Igneous and Metamorphic Rocks of the Tasco-Teloloapan Area, Guerrero, Mexico,* she concluded that the sequence of volcanic-sedimentary rocks in the Tasco-Teloloapan region had been deposited during the Mesozoic Era, rather than the Paleozoic Era as

was traditionally believed. This conclusion had significant implications for geological understanding at the time, since the presence of younger rocks could only be explained through Plate Tectonics. Her proposition generated considerable controversy within academic circles in Mexico, at a time when the theory of plate tectonics was just beginning to gain acceptance (Mejía-Echeverry, 2021:39–40). A distinctive feature of Campa was her extensive fieldwork, which enabled her to observe, record, systematize, discuss, interpret, and publish various aspects of Mexican geology through the leadership of exploration crews under her charge at PEMEX. The breadth of her academic and industrial practice was instrumental in the conceptual proposal of the tectono-stratigraphic terrains she developed and shared with her peers at conferences, symposia, courses, and specialized studies.

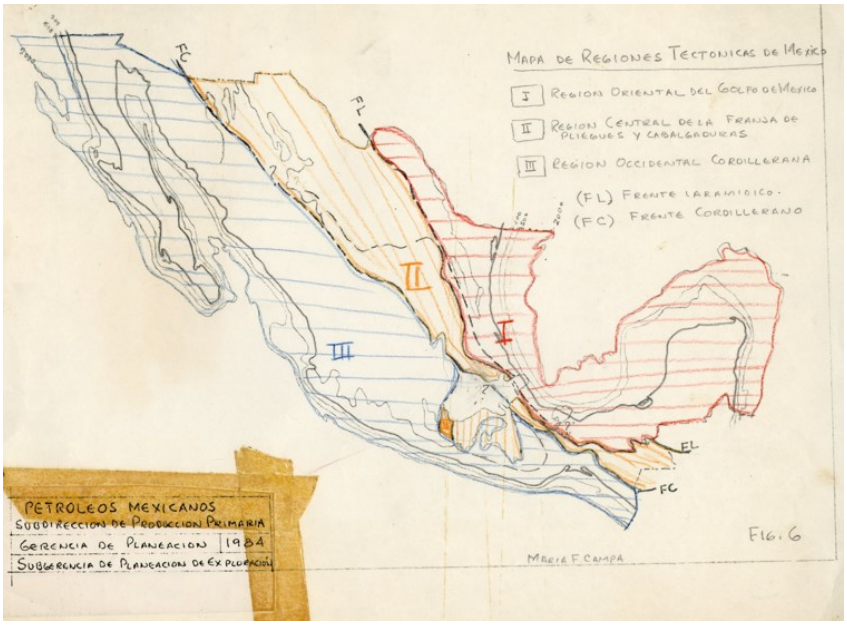

Fig. 3. Sketch of the Tectonic Regions Map of Mexico created by María Fernanda Campa for Petróleos Mexicanos in 1984. Courtesy of the Historical Archive of the Institute of Geology, UNAM.

During the 1970s, the lack of trained professionals for mineral extraction and oil well exploitation remained a significant challenge in Mexico. One of the centers formed for high-level specialization was the Mexican Petroleum Institute (IMP), an institution that, alongside the National Autonomous University of Mexico (UNAM), prepared cadres of scientists and engineers in petrochemicals, micropaleontology, structural geology, among other fields. María Fernanda Campa was one of the pioneers to receive scientific training in these institutions and to develop her academic work in relation to the industry. Her career facilitated the entry of generations of women into Mexican petroleum agencies, a reality that has existed in Mexico since the 1940s.

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